

What is claimed is:

1. A method of manufacturing a semiconductor device, comprising the steps of:

5 (a) providing a semiconductor substrate in which a floating gate electrode is formed;

(b) nitrifying the top of the floating gate electrode;

(c) forming a dielectric film along the step of the results; and

(d) forming a material film for a control gate electrode on the dielectric
10 film,

wherein the step of nitrifying the top of the floating gate electrode and the step of forming the dielectric film are implemented in-situ within the same chamber.

15 2. The method as claimed in claim 1, wherein the dielectric film has an ONO structure on which a first oxide film, a nitride film and a second oxide film are sequentially stacked.

3. The method as claimed in claim 1, wherein the steps (b) and (c)
20 that are in-situ implemented within the same chamber comprises the steps of:

introducing N_2O gas of 100 ~ 10000sccm at a temperature of 800 ~ 950 °C to nitrify the top of the floating gate electrode;

introducing N_2O gas and $DCS(SiH_2Cl_2)$ gas under a pressure of 0.1 ~ 3torr at a temperature of 790 ~ 830 °C to form a first oxide film along the step;

introducing DCS gas and NH_3 gas under a pressure of 0.1 ~ 3torr at a temperature of 650 ~ 800 °C to form a nitride film on the first oxide film; and

introducing N_2O gas and $\text{DCS}(\text{SiH}_2\text{CL}_2)$ gas under a pressure of 0.1 ~ 3torr at a temperature of 790 ~ 830 °C to form a second oxide film on the
5 nitride film.

4. The method as claimed in claim 2, wherein the ratio of $\text{DCS}(\text{SiH}_2\text{CL}_2)$ gas and N_2O gas is 1:5 ~ 1:10.

10 5. The method as claimed in claim 1, wherein formation of the floating gate electrode is accomplished by the steps of:

sequentially forming a tunnel oxide film, a first polysilicon film and a pad nitride film on the semiconductor substrate;

etching a part of the pad nitride film, the first polysilicon film, the
15 tunnel oxide film and the semiconductor substrate through a patterning process to form a trench within the semiconductor substrate;

depositing an oxide film on the entire structure including the trench and then making smooth the oxide film so that the pad nitride film is exposed;

etching the pad nitride film and then depositing a second polysilicon
20 film on the entire structure; and

patterning the second polysilicon film to form the floating gate electrode.

6. The method as claimed in claim 1, further comprising, between the steps (c) and (d), the step of implementing a steam anneal process of a wet

oxidization mode at a temperature of $750 \sim 800^{\circ}\text{C}$ so that the thickness of the dielectric film becomes $150 \sim 300 \text{ \AA}$.

7. A method of manufacturing a semiconductor device,
5 comprising the steps of:

(a) loading a semiconductor substrate in which a floating gate electrode is formed into a deposition chamber;

(b) changing the temperature within the deposition chamber to a first deposition temperature;

10 (c) nitrifying the top of the floating gate electrode at the first deposition temperature;

(d) changing the temperature within the deposition chamber to a second deposition temperature range;

15 (e) forming a dielectric film along the step in the second deposition temperature range to form a dielectric film; and

(f) unloading the semiconductor substrate from the deposition chamber.

8. The method as claimed in claim 7, wherein the first deposition temperature is $800 \sim 950^{\circ}\text{C}$ and the second deposition temperature range is
20 $650 \sim 830^{\circ}\text{C}$.

9. The method as claimed in claim 7, wherein the step (c) comprises introducing N_2O gas into the deposition chamber to nitrify the top of the floating gate electrode.

10. The method as claimed in claim 7, wherein the step (e) comprises the steps of:

introducing N_2O gas and $\text{DCS}(\text{SiH}_2\text{CL}_2)$ gas into the deposition
5 chamber to form the first oxide film;

introducing NH_3 gas and $\text{DCS}(\text{SiH}_2\text{CL}_2)$ gas into the deposition chamber to form the nitride film on the first oxide film; and

introducing N_2O gas and $\text{DCS}(\text{SiH}_2\text{CL}_2)$ gas into the deposition chamber to form the second oxide film on the nitride film.

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11. The method as claimed in claim 10, wherein the ratio of $\text{DCS}(\text{SiH}_2\text{CL}_2)$ gas and N_2O gas is 1:5 ~ 1:10.